Econometrica Supplementary Material

SUPPLEMENT TO "FEMALE LABOR SUPPLY, HUMAN CAPITAL, AND WELFARE REFORM"

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APPENDIX A: DATA

ESTIMATION IS BASED ON ALL 18 yearly waves of the British Household Panel Survey (BHPS), covering the period from 1991 to 2008.[1] Apart from those who are lost through attrition, all families in the original 1991 sample and subsequent booster samples remain in the panel from then onwards. Other individuals have been added to the sample in subsequent periods—sometimes temporarily—as they formed families with original interviewees or were born to them. All members of the household aged 16 and above are interviewed.

We select the sample of women in all types of family arrangement observed while aged 19 to 50. Our full data set is an unbalanced panel of 3,901 women observed for some varying period during the years 1991 to 2008. Almost 60% of these women were observed for at least 5 years and just over 20% were observed for at least 10 years; 25% are observed entering working life from education, and for 18% parental earnings when the respondent was aged 16–17 is observed. A great deal of information is collected for them, including family demographics, employment, working hours and earnings as well as those of a present partner, women's demographics such as age and education, demand for childcare and its cost. Moreover, historical data provide information on the characteristics of their parental home when they were aged 16, including whether lived with parents, parent's education, employment status, number of siblings and sibling order, books at home.

Some definitional and data preparation procedures should be mentioned for clarity. *Employment* is determined by present labor-market status and excludes self-employment. The paths of women who report being self-employed are deleted from that moment onwards. Only women working 5 or more hours per week are classified as employed. We consider employment choices from the age of 19 for women with secondary and high school education, and from the age of 22 for women with university education.

Working hours refer to the usual hours in main job including overtime. We discretized labor supply using a three-point distribution: not working (0 to 4 hours per week, modeled as 0 hours), working part-time (5 to 20 hours per week, modeled as 18 hours), and working full-time (21 hours or more per week,

[1] University of Essex. Institute for Social and Economic Research. (2010). British Household Panel Survey: Waves 1-18, 1991-2008. [data collection]. 7th Edition. UK Data Service. SN: 5151, http://dx.doi.org/10.5255/UKDA-SN-5151-1.

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modeled as 38 hours). The employment status and working hours observed at one point in the year are assumed to remain unaltered over the entire year.

Earnings are the usual gross weekly earnings in the main job. (*Hourly*) *wage rates* are the ratio of weekly earnings to weekly hours capped at 70. The wage distribution is trimmed at percentiles 2 and 99 from below and above, respectively, and only for women working at or above 5 hours per week to reduce the severity of measurement error in wage rates.

Wage rates are detrended using the aggregate wage index (for both men and women of all education levels), and all other monetary parameters in the model, including all monetary values in the annual sequence of tax and benefit systems, were deflated using the same index. To construct this index, we run three regressions, one for each education level, of trimmed wages on time dummies and dummies of Scotland and Wales. We create three education-specific wage indices from the coefficients in time. Then we aggregate these indices using the distribution of education for the entire population of workers aged 25–59 in the sample. This is the wage index we use. Any real monetary values (using the CPI) are then rescaled using this index.

Family type includes four groups: single women and couples without children, lone mothers, and couples with children. Women are assumed to have children only after finishing education, once entering the labor market. Cumulated *work experience* is measured in years. *Individual assets* at the beginning of adult life are the total of savings and investments net of debts. They are truncated at zero, never allowed to be negative. *Education* is classified in three categories: secondary or compulsory (completed by the age of 16), high school or equivalent (corresponding to A-levels or equivalent qualifications), and university (3-year degrees and above).

APPENDIX B: PARAMETERS ESTIMATED OUTSIDE THE STRUCTURAL MODEL

Externally Set Parameters

Two parameters are chosen from pre-existing estimates: the coefficient, μ, set to -0.56, giving a risk-aversion coefficient of 1.56 (consistent with evidence in Blundell, Browning, and Meghir (1994) and Attanasio and Weber (1995)). This choice implies that the utility is always negative, and so the higher is the argument in the exponential—U in equation (1)—the lower is overall utility. Hence, positive and larger values of the parameters in U make working less attractive. The discount factor, β, is set to 0.98, a typical value in the literature (see, e.g., Attanasio, Low, and Sanchez-Marcos (2008)). Moreover, the risk-free interest rate is set to 0.015, which is slightly lower than the discount rate, thus implying that agents have some degree of impatience. Tuition costs of university education amount to £3,000 (uprated to 2008 prices) for the three-year program and the credit limit for university students (and graduates throughout their life) is £5,000 (also uprated to 2008 prices), both reflecting the university education policy of the late 1990s in the U.K. For everyone else, credit is constrained.

Family Transitions

Family transition probabilities were estimated using linear probability regressions, weighted to ensure an equal number of women at each age.

The probability of a partner arriving is estimated by regressing a dummy for partner arrival on a fourth-order polynomial in female age among single women aged 55 or less. This is done separately for each of the nine combinations of female and partner education level. Arrival probabilities in the first period of working life are taken directly from the data, and are set to zero after 55. The probability of a partner leaving is also described by a fourth-order polynomial in female age, estimated on all women aged 20–69. This is done separately by spouses' education and presence of children.

The probability of a child arriving is estimated by regressing a dummy for child arrival on a second-order polynomial in female age and, for families with children, a second-order polynomial in age of next youngest child and a linear interaction with female age. This is done separately for each female education level and by couple status. The probability of a child arriving is set to zero from when the woman reaches 43 onwards.

Figure 11 shows the distribution of family composition by female age and education for both observed data and model simulations. The displayed simulated profiles are reasonably close to the observed data ones. They show that secondary-educated women are more likely to become mothers early on and to experience lone-motherhood than high school and university graduates.

Male Employment and Earnings

Table XIX reports the estimates for male working status and earnings by his education. This is relevant only for women in couples, as we do not seek to solve the men's problem. However, the partner's employment and income changes the family budget constraint and the work incentives of women in couples.

Rows 1 to 3 display estimates from a probit regression and show that the employment probability generally increases with education and is very persistent (row 3). Estimates for the log wage equation suggest only mild differences in wage rates by education (row 4) but strong differences in wage progression, with more educated men experiencing steeper wage profiles over time (row 5). We set the autocorrelation coefficient in the male productivity process to 0.99, close to a unit root. Having tried several alternative exclusion restrictions within a Heckman (1979) selection model of male employment and earnings, we found no evidence of statistically significant selection. Hence, we

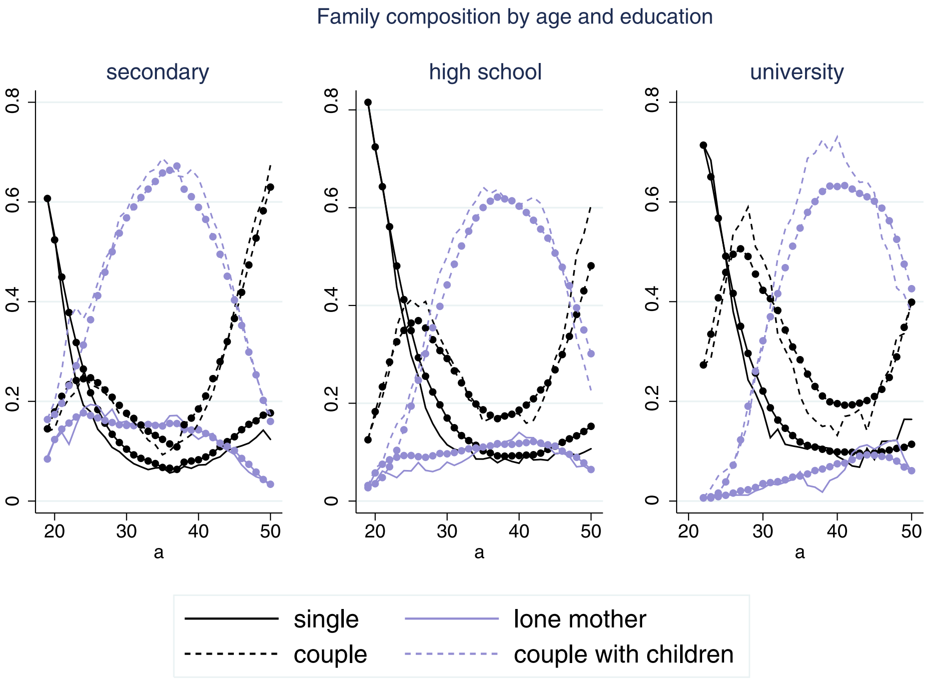

FIGURE 11.—Family demographics by female age—data and simulations. Notes: Distribution of family types by age of woman. Data in solid lines, simulations in dashed lines.

assume that the residuals in the employment and wage equations are uncorrelated.

Families with positive childcare costs pay £2.60 (standard error 0.04) per working hour. Childcare is required for every hour when all adults in the household are working if the child is 5 or younger, and is only necessary for older children under the age of 10 if all adults work full-time.

APPENDIX C: COMPUTATIONAL DETAILS ON THE SOLUTION AND ESTIMATION OF THE MODEL

The estimation and simulation exercises require the solution of the female life-cycle model. Since there is no analytical solution to the problem, we approximate numerically the policy functions for labor supply, consumption, and education choices conditionally on the woman's information at each period of her life (the state variables, described by X at the start of Section 4.2). We do this by backward recursion, starting from the end of life (age 70).

A key feature of our model is that it models the joint consumption and labor supply decisions over the working years of women, where the former is a continuous choice while the latter is discrete. The numerical solution of prob-

TABLE XIX

EXOGENOUS PARAMETERS: MARRIED MEN EMPLOYMENT AND WAGE RATES BY EDUCATION[a]

		Man's Education		
		Secondary	Further	Higher
		Employment probabilities		
(1)	New couples	0.74 (0.02)	0.87 (0.02)	0.83 (0.03)
(2)	Ongoing couples: intercept	0.05 (0.02)	0.37 (0.02)	0.58 (0.04)
(3)	Ongoing couples: previously employed	1.52 (0.03)	1.40 (0.03)	1.28 (0.06)
		Log wage equation		
(4)	Log wage rates	1.94 (0.07)	2.07 (0.08)	2.05 (0.15)
(5)	Log woman's age minus 18	0.09 (0.04)	0.18 (0.03)	0.35 (0.07)
(6)	St. deviation of innovation to productivity (new couples)	0.37 (0.12)	0.36 (0.13)	0.39 (0.18)
(7)	St. deviation of innovation to productivity (ongoing couples)	0.12 (0.04)	0.10 (0.03)	0.10 (0.5)

[a]Standard errors in parentheses below the estimate. Sample sizes are: 665 observations for new couples, 31,946 observations for all couples, and 16,318 for continuously employed men.

lems with simultaneous discrete and continuous choices is considerably harder than that of problems with only continuous or only discrete choices, explaining the limited existing work on such models. Some studies (e.g., French and Jones (2011), Adda, Dustmann, and Stevens (2015)) have opted for discretizing the space of the continuous choice. More recently, solution methods to handle discrete and continuous choices have been proposed by Fella (2014) and Iskhakov, Jorgensen, Rust, and Schjerning (2015). Our solution method is close but not identical to the methods advanced by these two papers, and hence we describe it here.

The main difficulty in solving dynamic problems that combine discrete and continuous choices is that the smoothness and concavity of the value function that is typical of continuous problems—and that ensures the existence and uniqueness of a solution that is itself continuous and, if interior, is the root of the optimality condition (Euler equation)—does not hold in a problem with a discrete choice variable. The addition of a discrete choice makes the value function piecewise concave, with kinks falling at the points where the agent is indifferent between any two possible alternatives along the discrete choice domain; these then translate into discontinuities in the optimal choice of the continuous variable (consumption or savings).

Kinks created by present choices at time t—what Iskhakov et al. (2015) called *primary kinks*—do not pose difficulties. They can be dealt with by conditioning the continuous choice on the discrete choice in a first step, followed by the choice of the alternative with highest value in the second step. This is computationally more demanding than the purely continuous problem because the root of the Euler equation must be calculated for each point in the domain of the discrete choice, but the solution method is a trivial extension of that for a purely continuous problem.

However, kinks propagate backwards through the (expected) continuation values—the *secondary kinks*. These are caused by indifference points in future choices, from $t+1$ onwards, and hence cannot be easily conditioned on. The further back one moves, the more kinks there will be. Furthermore, associated with secondary kinks are discontinuities in future choices, which need to be accounted for in the Euler equation, as they affect the marginal utility of the continuous choice variable at both time t and $t+1$. This implies that the Euler equation is no longer a sufficient optimality condition, even after conditioning on the discrete choice at time t.

As noticed by Iskhakov et al. (2015) and others before them (e.g., Gomes, Greenwood, and Rebelo (2001)), kinks can be eliminated and the expected continuation value can be "concavified" by uncertainty. This is the approach we explore given the rich characterization of uncertainty we account for in the model.

In our problem, the kinks in the value function occur at the level of assets where the woman is indifferent between working full-time/part-time/not working, or at points in assets that lead optimally to indifference points in the future (all conditional on her present state). To see why, consider the value function for a given woman at working-life age t facing state X_t. Her value function is

$$V_t(X_t) = \max_{l_t \in \mathcal{L}(X_t)} \bigl\{ V_t(X_t | l_t = \mathrm{O}), V_t(X_t | l_t = \mathrm{P}), V_t(X_t | l_t = \mathrm{F}) \bigr\}, \tag{14}$$

where

$$V_t(X_t | l_t = l) = \max_{c_t \in \mathcal{C}(X_t, l)} \bigl\{ u(c_t, l; X_t) + \beta \mathrm{E}\bigl[V_{t+1}(X_{t+1}) | X_t, l\bigr] \bigr\}. \tag{15}$$

$\mathcal{L}(X)$ represents the feasibility space for labor supply l given X and $\mathcal{C}(X, l)$ is the feasibility space for consumption c given (X, l). In the above expression, the expectation in the continuation value is taken with respect to the transition probability in a subset of variables in X: the woman's productivity shock (υ), the arrival of a new child (t^k changing to zero), the formation or dissolution of a marriage (m), the education of a new spouse $(\tilde{s})$, and the employment and productivity of a present spouse $(\tilde{l}, \tilde{\upsilon})$.

We are concerned with kinks in EV_{t+1}. Clearly, for as long as the transition function for $(\upsilon, t^k, m, \tilde{s}, \tilde{l}, \tilde{\upsilon})$ is non-degenerate and the kinks at $t+1$ vary with

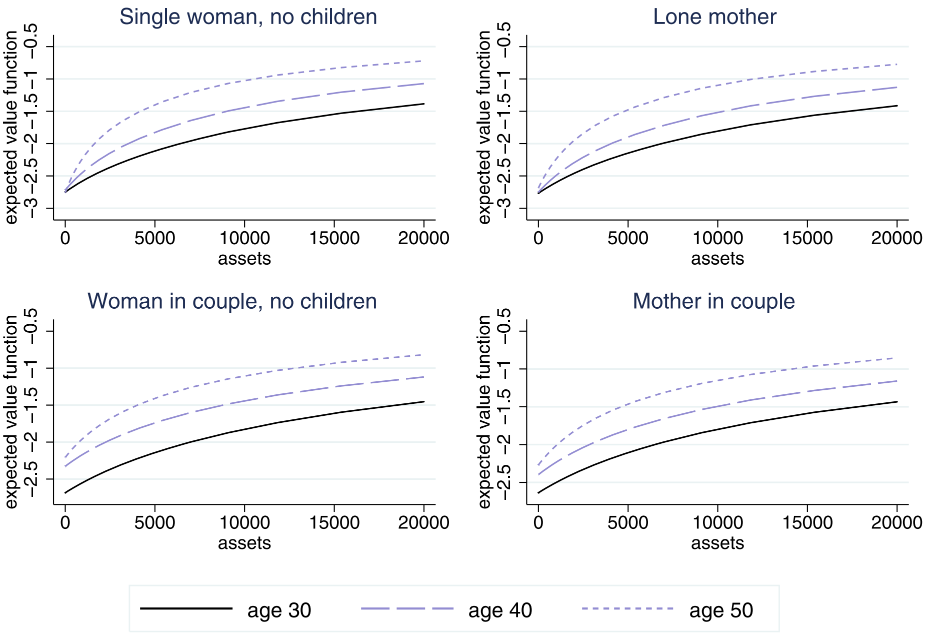

FIGURE 12.—Expected value functions; by age, family demographics, and assets. Notes: Lines are numerical approximations of the value functions at selected age and family demographics by assets. Plots are for women of type I in utility cost of work, low background factors 1 and 2, with compulsory education only and at their average productivity level, the age of the youngest child is 10 for mothers, and the spouses of women in couples have completed compulsory education only and are working at their average productivity.

these variables, their presence will dilute the kinks in EV_{t+1}. Whether it is sufficient to "concavify" the expected value function is a practical question. Using a fine grid of 50 points in assets, we inspect the concavity of our numerical approximation of the expected value function. This is a finer grid than we use to solve and estimate the model; it is used here with the purpose of finding nonconcavities that could have been missed with a coarser grid. Figure 12 shows some examples of the profile of the expected value functions for different age groups. We have exhaustively inspected the value function at other points in the state space based both on the finer grid in assets used here and the coarser grid used for estimation and simulation. We found no evidence at the estimated parameterization, that the expected value function is not globally concave.

Given a set of parameters and the solution of the female problem at time $t+1$, the critical step in the solution at time t is to calculate the optimal level of consumption (or, equivalently, next period assets) at each possible realization of the labor supply choice (l). This amounts to solving for the root of the Euler equation

$$c_t(X_t; l_t) = (u'_l)^{-1}\big(\beta R\mathrm{E}\big[u'(c_{t+1}(X_{t+1}))|X_t, l_t\big]\big) \\ = (u'_l)^{-1}\Bigg(\beta R \sum_{l_{t+1}=\mathrm{O,P,F}} \mathrm{Prob}(l_{t+1}|X_t, l_t) \\ \times \mathrm{E}\big[u'(c_{t+1}(X_{t+1}))\big| X_t, c_t, l_t\big]\Bigg), \tag{16}$$

where the $(u'_l)^{-1}$ is the analytical inverse of the utility function with respect to consumption conditional on labor supply l, and is evaluated at the expected marginal utility of consumption at $t+1$, a function of the state variables at $t+1$. The expectations are conditional on information and choices at t.

A couple of comments are due at this stage. First, for a standard dynamic problem with continuous choice and a twice continuously differentiable and concave utility function, the policy function is monotonic in assets and there is a single solution to the above equation. This can be quickly located by searching for the point in consumption at which the difference between the right-hand side (r.h.s.) and the left-hand side (l.h.s.) of equation (16) changes sign. Fella (2014) showed that the monotonicity result extends to dynamic problems with discrete and continuous choice away from kinks since the value function is concave between any two consecutive kinks. Hence, there is at most a single interior solution within each concave section of the value function, which needs to be calculated so the global optimum can be determined. While Figure 12 shows that, in our problem and for the estimated set of parameters, the expected value function is globally concave—ensuring that condition (16) is sufficient for an interior optimum—we do check for multiple roots during estimation since global concavity may not hold over the entire parameter space.

Second, although our solution approach to the approximation of the optimal consumption function is in the spirit of Carroll's Endogenous Grid Point method (Carroll (2006)), we do not follow his strategy of endogenously selecting a grid for assets at time t by solving equation (16) backwards having set a grid for assets at $t+1$. Instead, we follow the traditional approach of selecting a fixed grid in assets at time t and solve for the optimal consumption (or assets at $t+1$). This is facilitated by the observation that the r.h.s. of (16) is nearly linear in assets at $t+1$ (or consumption at t) over most of its space. This is shown in Figure 13. We therefore use linear interpolation to solve the Euler equation on a grid of assets that is finer towards the lower bound of its domain, where the problem is more nonlinear.

The following algorithm describes the solution procedure at time t, given the expected value and marginal utility functions at time $t+1$. For convenience, we split the state variables in two sets, depending on whether their realization is known or not from the viewpoint of the previous period, conditional on choice. So $X_t = (\Omega_t, \omega_t)$ where $\Omega = (\theta, x_1, x_2, s, a_t, e_t)$ is known by the woman at $t-1$

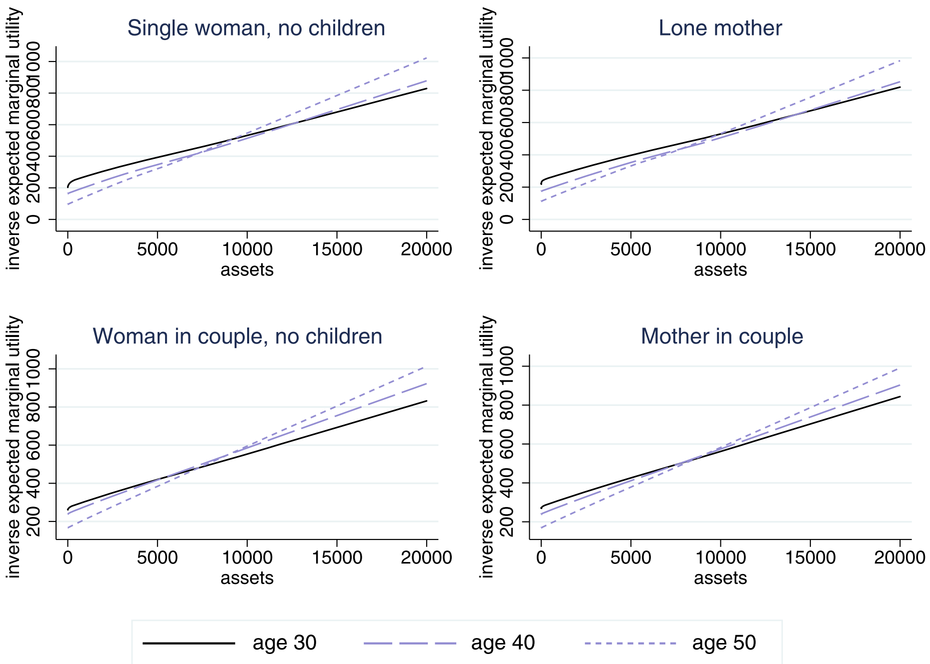

FIGURE 13.—Inverse marginal utility applied to the expected marginal utility function; by age, family demographics, and assets. Notes: Lines are numerical approximations of the functions at selected age and family demographics by assets. Plots are for women of type I in utility cost of work, low background factors 1 and 2, with compulsory education only and at their average productivity level, the age of the youngest child is 10 for mothers, and the spouses of women in couples have completed compulsory education only and are working at their average productivity.

conditional on choice, and $\omega = (\upsilon_t, k_t, t_t^k, m_t, \tilde{s}_t, \tilde{l}_t, \tilde{\upsilon})$ is uncertain. The goal is to compute the expected value function (EV_t) and the expected marginal utility function evaluated at the optimal choices (Eu'_t), where expectations are taken at $t-1$. Ω_t is known at $t-1$ conditional on the choices at that time, but ω_t is not and needs to be integrated out. Hence, EV_t and Eu'_t are functions of (Ω_t, ω_{t-1}).

Inputs. These include:

1. Numerical approximations of the expected value function and the expected marginal utility of consumption evaluated at the optimal choices at $t+1$. These are functions of (Ω_{t+1}, ω_t): $\mathrm{EV}_{t+1}(\Omega_{t+1}, \omega_t)$ and $\mathrm{Eu}'_{t+1}(\Omega_{t+1}, \omega_t)$.

2. Grids for all predetermined continuous variables at t: assets, experience (a_t, e_t).[53] The support of the discrete state variables (including the woman's

[53]We use a grid of six points in each of the variables (a, e). The grid points in assets and experience are more concentrated towards the bottom of the domain of each variable, where the problem is more nonlinear.

family background, education, and preferences for working, whether children are present and the age of the youngest, whether she faces childcare costs as a mother of a young child, the presence of a partner, his education and employment status) is fully represented in the solution.

3. Grids for the random productivity shocks on the wage rates of the woman and present partner at time t, $(\upsilon_t, \tilde{\upsilon}_t)$.[54] The grid points in the productivity shocks are the midpoints (median) of the equal probability adjacent intervals of their entire support and hence the quadrature weights are constant.

Step 1. Approximate the policy function for consumption conditional on labor supply:

For each grid point of female characteristics (family background (x_1, x_2), preference type θ, education s, working experience e, and productivity level υ), family demographics (children k, age of youngest child t^k, partner m), and the characteristics of a present partner (education $\tilde{s}$, employment status $\tilde{l}$, and productivity $\tilde{\upsilon}$):

1. Compute total family resources after taxes and benefits, call it I_t;
2. Compute next period experience, e_{t+1};
3. Interpolate $\mathrm{Eu}'_{t+1}(\Omega_{t+1}, \omega_t)$ at e_{t+1};
4. Compute $c_t(X_t; l_t)$ that solves equation (16) by linear interpolation of $(u'_l)^{-1}(\mathrm{Eu}'_{t+1}(\Omega_{t+1}, \omega_t))$ at $a_{t+1} = I_t - c_t(X_t; l_t)$;
5. Calculate $V_t(X_t; l_t = l)$ as in equation (15) by interpolating $\mathrm{EV}_{t+1}(\Omega_{t+1}, \omega_t)$ at $a_{t+1} = I_t - c_t(X_t; l_t)$.

Step 2. Compute the unconditional optimum:

1. Compute optimal labor supply by selecting the value of l that maximizes $V_t(X_t; l)$;
2. Store the value function $V_t(X_t)$ and the marginal utility of consumption evaluated at the optimal choice, $u'(X_t)$.

Step 3. Calculate the expected value and marginal utility functions at time t as functions of (Ω_t, ω_{t-1}):

1. For each point in the grid of $(\upsilon_{t-1}, \tilde{\upsilon}_{t-1})$: integrate $V_t(X_t)$ and $u'(X_t)$ over the distribution of productivity shocks $(\upsilon_t, \tilde{\upsilon}_t)$ conditional on $(\upsilon_{t-1}, \tilde{\upsilon}_{t-1})$;
2. For each possible family type and spouse's employment status at $t - 1$: integrate the resulting functions over the family transition rule and the employment probability of a present spouse.

Outputs. Period t expected functions $\mathrm{EV}_t(\Omega_t, \omega_{t-1})$ and $\mathrm{Eu}'_t(\Omega_t, \omega_{t-1})$.

Simulations are based on initial conditions for family background and parental income observed in the data, together with random draws of the entire profile of unobserved shocks. Given this information, individual optimal choices are calculated starting from the beginning of active life, age 17, and moving forward. As for the solution, the optimum is computed at each age in two steps, first by solving the Euler equation to calculate optimal savings at

[54] We use a grid of six points in $\tilde{\upsilon}$ and of 12 points in υ to ensure that the domain of uncertainty in female wages, a key determinant of labor supply, is well covered.

each labor supply point, then by selecting the labor supply that achieves maximum total utility. In doing so, however, the problem must now be evaluated outside the grid chosen for solution. In practice, this means that the continuation functions need to be interpolated over up to four dimensions: future assets and experience as before, along with present productivity shocks (for both spouses if women are married). We do this by linear interpolation.

Estimation. The estimation procedure is implemented in two steps. The first step estimates all the exogenous parts of the model, including the dynamics of family formation (marriage, divorce, fertility, male labor supply and earnings, and the cost of childcare). In addition, two parameters are exogenously set: the coefficient of risk aversion and the discount rate.

The second step implements an iterative procedure to estimate the preferences and wages of women within the structural model. In each iteration, we start by solving the female life-cycle problem for a particular set of the estimating parameters, given the economic environment and the exogenously set parameters. We then simulate five replications of the life-cycle choices of 3,901 women observed in the data, conditional on observed family background and parental income. The same sequences of lifetime shocks are used in all iterations of the estimation procedure to avoid changes in the criterion function due to changes in the random draws. For each woman, we select an observation window such that the overall simulated sample exactly reproduces the time and age structure of the observed data. The simulations assume women face up to four policy regimes over the observation window, representing the main tax and benefit systems operating during the 1991–2008 period. We used the 1995, 1999, 2002, and 2004 regimes and assumed they operate over the periods prior to 1996, 1997 to 1999, 2000 to 2002, and 2003 onwards, respectively. Women into their active life over the entire period will experience all of these regimes at different stages of their lives. Younger and older women, who either enter or leave active life within our observation window, will experience only some of these policy regimes during the life period that we are modeling. We assume that women expect the tax and benefit system they face in each period to be permanent, so all reforms arrive unexpectedly. Finally, we calculate the simulated moments using the simulated data set and the objective function. We use 248 moments to estimate 89 parameters.

The parameters are selected to minimize the distance between sample and simulated moments, where the weighting matrix is the inverse variance-covariance matrix of the data moments as described in equation (13) in the main text. The procedure described above calculates the value of the criterion function in each iteration of the optimization routine. Given the discrete choice of labor supply, our criterion may not be a smooth function of the model parameters everywhere in their domain (McFadden (1989)). We therefore use an optimization routine that does not rely on derivatives. Specifically, we choose to use the Bound Optimization By Quadratic Approximation, which generates, in each iteration, a quadratic approximation of the criterion function that matches the criterion in a set of interpolation points (see Powell (2009); implementation by Nag).

APPENDIX D: MODEL FIT

Tables XX to XXX display the full list of data moments used in estimation, together with their simulated counterparts and the normalized (by the data standard error) differences between the two. The estimation procedure was based on 248 moments, including education distribution and regressions (Tables XX and XXI), employment rates (Table XXII), transition rates into and out of work (Tables XXIII and XXIV), coefficients from log wage regressions, percentiles of the distribution of log wages and year-to-year changes in wage rates by past working hours, age, and years of work (Tables XXV to XXIX), and the probability of positive childcare costs (Table XXX). All moments are education-specific. Among the 254 simulated moments, 44 fall outside the 95% confidence interval for the respective data moment, but many amongst these are very similar to their BHPS counterparts.

TABLE XX

EDUCATIONAL DISTRIBUTION

Moment	Data	Simulated	SE Data	No. SE Diff
		Secondary education		
All	0.248	0.251	0.020	0.108
Low background factor 1	0.411	0.411	0.046	0.000
High background factor 1	0.196	0.199	0.021	0.140
Low background factor 2	0.284	0.295	0.029	0.382
High background factor 2	0.206	0.197	0.027	0.316
		High school		
All	0.481	0.482	0.023	0.038
Low background factor 1	0.473	0.459	0.047	0.303
High background factor 1	0.484	0.490	0.027	0.217
Low background factor 2	0.524	0.523	0.032	0.025
High background factor 2	0.431	0.433	0.034	0.083
		University		
All	0.270	0.267	0.021	0.147
Low background factor 1	0.116	0.130	0.031	0.463
High background factor 1	0.320	0.311	0.025	0.352
Low background factor 2	0.192	0.182	0.025	0.409
High background factor 2	0.364	0.369	0.033	0.174

TABLE XXI

EDUCATION REGRESSIONS

Moment	Data	Simulated	SE Data	No. SE Diff
		High school		
Constant	0.476	0.473	0.034	0.072
Cohort 82+	−0.013	−0.012	0.055	0.034
Background factor 1	0.009	0.012	0.020	0.140
Background factor 2	−0.042	−0.038	0.016	0.236
Cohort 82+ × factor 1	−0.010	−0.008	0.031	0.059
Cohort 82+ × factor 2	−0.005	−0.017	0.026	0.426
Log parental income	−0.010	−0.021	0.051	0.222
		University		
Constant	0.192	0.198	0.021	0.263
Cohort 82+	0.018	−0.014	0.037	0.884
Background factor 1	0.076	0.077	0.012	0.087
Background factor 2	0.067	0.071	0.012	0.305
Cohort 82+ × factor 1	0.004	−0.001	0.024	0.222
Cohort 82+ × factor 2	−0.038	0.012	0.022	2.200
Log parental income	0.118	0.119	0.048	0.021

APPENDIX E: MARSHALLIAN ELASTICITIES IN MODELS WITH AND WITHOUT SAVINGS

In Table XXXI we show the Marshallian elasticities obtained when the model excludes all savings (except student loans) and compares them to those obtained by the main model, which allows people to save. The model is re-estimated by imposing the constraint that consumption is equal to income in each period.

APPENDIX F: TAX AND BENEFIT REFORMS

Here we provide a brief description of the U.K. tax and transfer system.[55] We focus on reforms between four systems—April 1995, April 1999, April 2002, and April 2004—that represent four different regimes in terms of the generosity and structure of taxes and transfers. These systems are the ones we use in estimation.

Table XXXII sets out the most important tax rates and thresholds for the two main personal taxes on earnings: income tax and National Insurance. Both are individual-based and operate through a system of tax-free allowances and income bands that are subject to different rates of tax.

Between April 1995 and April 1999, the main income tax and National Insurance reforms were as follows. For income tax, the personal allowance and

[55]For a more comprehensive discussion of U.K. taxes and transfers, see Browne and Roantree (2012) and Browne and Hood (2012).

TABLE XXII

EMPLOYMENT BY EDUCATION

	Secondary				High School				University			
Moment	Data	Sim	SE Data	SE Diff	Data	Sim	SE Data	SE Diff	Data	Sim	SE Data	SE Diff
					All employment							
All	0.721	0.705	0.011	1.475	0.825	0.817	0.011	0.782	0.870	0.863	0.014	0.456
Single women, no child	0.914	0.885	0.012	2.515	0.911	0.938	0.012	2.247	0.939	0.950	0.011	1.037
Married women, no child	0.885	0.887	0.013	0.179	0.950	0.937	0.008	1.600	0.948	0.942	0.010	0.552
Lone mothers	0.452	0.432	0.031	0.654	0.672	0.650	0.046	0.473	0.858	0.761	0.056	1.729
Married mothers	0.639	0.637	0.016	0.122	0.722	0.717	0.018	0.283	0.770	0.764	0.029	0.197
Partner working	0.759	0.751	0.012	0.710	0.823	0.825	0.013	0.203	0.848	0.854	0.019	0.322
Youngest child 0–2	0.415	0.403	0.020	0.590	0.595	0.560	0.026	1.375	0.701	0.680	0.034	0.598
Youngest child 3–5	0.525	0.534	0.022	0.422	0.709	0.676	0.025	1.282	0.735	0.764	0.041	0.706
Youngest child 6–10	0.708	0.690	0.020	0.899	0.774	0.792	0.024	0.718	0.862	0.833	0.031	0.930
Youngest child 11+	0.805	0.781	0.019	1.292	0.854	0.869	0.024	0.612	0.895	0.865	0.039	0.758
Family bkg: factor 1	0.746	0.736	0.017	0.615	0.819	0.829	0.014	0.716	0.870	0.875	0.015	0.323
Family bkg: factor 2	0.713	0.721	0.017	0.477	0.824	0.820	0.015	0.235	0.867	0.861	0.020	0.311
Before-after (1999) difference	0.028	0.018	0.010	0.960	0.014	0.017	0.008	0.368	0.025	0.005	0.012	1.632
					Part-time employment							
All	0.207	0.199	0.009	0.906	0.159	0.158	0.010	0.112	0.123	0.122	0.012	0.071
Single women, no child	0.055	0.046	0.011	0.857	0.053	0.033	0.009	2.335	0.040	0.033	0.012	0.518
Married women, no child	0.125	0.117	0.013	0.660	0.059	0.053	0.010	0.541	0.034	0.039	0.008	0.612
Lone mothers	0.181	0.177	0.023	0.193	0.167	0.159	0.032	0.229	0.097	0.088	0.037	0.250
Married mothers	0.298	0.287	0.013	0.870	0.279	0.282	0.017	0.160	0.243	0.240	0.025	0.107
Partner working	0.248	0.236	0.011	1.093	0.190	0.197	0.012	0.508	0.148	0.155	0.016	0.414
Youngest child 0–2	0.219	0.220	0.015	0.096	0.256	0.257	0.020	0.064	0.241	0.243	0.028	0.059
Youngest child 3–5	0.301	0.284	0.020	0.864	0.317	0.292	0.026	0.927	0.256	0.254	0.036	0.044
Youngest child 6–10	0.332	0.329	0.020	0.168	0.284	0.307	0.025	0.914	0.235	0.226	0.041	0.215
Youngest child 11+	0.273	0.231	0.022	1.898	0.192	0.183	0.027	0.332	0.170	0.156	0.044	0.330
Family bkg: factor 1	0.170	0.173	0.013	0.216	0.152	0.143	0.012	0.793	0.127	0.114	0.014	0.937
family bkg: factor 2	0.203	0.195	0.013	0.592	0.172	0.146	0.014	1.913	0.112	0.117	0.015	0.358
Before-after (1999) difference	−0.020	−0.003	0.009	2.024	−0.013	0.001	0.008	1.646	0.001	−0.002	0.011	0.236

TABLE XXIII

TRANSITION RATES FROM OUT OF WORK INTO WORK

Moment	Data	Simulated	SE Data	No. SE Diff
		Secondary education		
All	0.180	0.210	0.009	3.194
Women with no children	0.272	0.321	0.036	1.339
Lone mothers	0.114	0.133	0.016	1.223
Married mothers	0.183	0.209	0.011	2.226
		High school		
All	0.255	0.236	0.016	1.132
Women with no children	0.503	0.333	0.050	3.409
Lone mothers	0.186	0.189	0.037	0.084
Married mothers	0.210	0.224	0.017	0.814
		University		
All	0.276	0.221	0.031	1.771
Women with no children	0.585	0.326	0.059	4.381
Lone mothers	0.294	0.167	0.082	1.545
Married mothers	0.188	0.191	0.029	0.120

basic rate limit rose in real terms by 11% and 4%, respectively. The starting rate was cut from 20% to 10%, but the starting rate limit reduced substantially (58%). Also, the basic rate was cut from 25% to 23%. For National Insurance, the 2% "entry fee" (cliff edge) payable as soon as earnings exceeded the lower earnings limit was abolished.

Between April 1999 and April 2002, the basic rate of income tax was further reduced from 23% to 22% and the additional allowance for couples was abolished. In addition, in National Insurance, the lower earnings limit/primary threshold and upper earnings limit rose by 27% and 10%, respectively.

Between April 2002 and April 2004, the income tax personal allowance and National Insurance primary threshold both declined by 3% in real terms. Also, in National Insurance, the main rate and the rate above upper earnings limit both rose by 1%.

The system of transfers in the U.K. is more complex. Most transfers are strongly contingent on family circumstances and are means-tested at the family level. The main transfer programs for working-age individuals in existence at some point across the four systems of interest are as follows. Child Benefit is a universal (non-means-tested) benefit available for families with children. Income Support (together with Income-Based Jobseeker's Allowance) is an out-of-work means-tested benefit that tops net family income up to a specified level based on family needs. Children's Tax Credit is a tax rebate available to families with children. (It is actually part of the tax system but is included here because of the way it was reformed, discussed below.) Family Credit and Working Families' Tax Credit are means-tested benefits for working families

TABLE XXIV

MEAN TRANSITION RATES FROM EMPLOYMENT TO OUT OF WORK

Moment	Data	Simulated	SE Data	No. SE Diff
		Secondary education		
All	0.064	0.071	0.004	1.914
Women with no children	0.032	0.042	0.004	2.552
Lone mothers	0.146	0.164	0.019	0.920
Married mothers	0.085	0.085	0.006	0.137
Past wage in bottom decile ($w_{t-1} < Q10$)	0.111	0.121	0.011	0.903
$w_{t-1} < Q50$	0.072	0.083	0.005	2.205
$w_{t-1} < Q90$	0.063	0.072	0.004	2.420
		High school		
All	0.056	0.052	0.004	1.027
Women with no children	0.030	0.025	0.004	1.538
Lone mothers	0.092	0.103	0.019	0.574
Married mothers	0.086	0.078	0.008	0.999
$w_{t-1} < Q10$	0.135	0.111	0.018	1.397
$w_{t-1} < Q50$	0.079	0.074	0.007	0.730
$w_{t-1} < Q90$	0.056	0.055	0.004	0.089
		University		
All	0.040	0.035	0.005	0.995
Women with no children	0.026	0.020	0.005	1.202
Lone mothers	0.037	0.072	0.022	1.598
Married mothers	0.061	0.056	0.009	0.500
$w_{t-1} < Q10$	0.077	0.114	0.036	1.004
$w_{t-1} < Q50$	0.079	0.071	0.014	0.590
$w_{t-1} < Q90$	0.044	0.043	0.006	0.213

with children. They are structurally very similar to each other. Working Tax Credit is a means-tested benefit for working families that is more generous for families with children but also available to childless families. Child Tax Credit is a means-tested benefit for families with children that is not contingent on working. Working Tax Credit and Child Tax Credit are subject to a joint taper. Finally, Housing Benefit and Council Tax Benefits are means-tested benefits that help low-income families meet, respectively, rent payments and council tax bills.

Table XXXIII sets out maximum entitlements and taper rates for transfers that were reformed across our four systems of interest. It considers six example low-wage family types to demonstrate who were the main gainers and losers from each reform. Housing Benefit and Council Tax Benefit are not included because changes to these transfer programs were relatively minor.

Between April 1995 and April 1999, the main change was the abolition of the lone parent rate of Child Benefit, affecting lone parents. There were also some

TABLE XXV

LOG WAGES ($\ln w$) AT ENTRANCE IN WORKING LIFE[a]

Moment	Data	Simulated	SE Data	No. SE Diff
		Secondary education		
Mean	1.806	1.764	0.019	2.153
Variance	0.072	0.077	0.007	0.694
Mean: high factor 1	1.840	1.764	0.023	3.298
Mean: high factor 2	1.823	1.767	0.033	1.733
Wage: bottom quartile ($w_t < Q25$)	0.249	0.271	0.031	0.715
$w_t < Q50$	0.503	0.585	0.037	2.237
$w_t < Q75$	0.751	0.782	0.031	1.008
		High school		
Mean	1.825	1.862	0.018	2.023
Variance	0.094	0.110	0.007	2.401
Mean: high factor 1	1.825	1.875	0.022	2.321
Mean: high factor 2	1.816	1.889	0.030	2.410
Wage: bottom quartile ($w_t < Q25$)	0.250	0.213	0.025	1.480
$w_t < Q50$	0.500	0.456	0.029	1.506
$w_t < Q75$	0.750	0.704	0.026	1.783
		University		
Mean	2.095	2.068	0.025	1.039
Variance	0.118	0.128	0.011	0.884
Mean: high factor 1	2.088	2.059	0.027	1.091
Mean: high factor 2	2.121	2.049	0.034	2.123
Wage: bottom quartile ($w_t < Q25$)	0.247	0.290	0.032	1.351
$w_t < Q50$	0.500	0.492	0.038	0.226
$w_t < Q75$	0.753	0.775	0.032	0.685

[a]Statistics in this table are for 19- to 22-year-old women in the two lowest education levels, or 22- to 25-year-old university graduates.

modest increases in generosity in Family Credit across all low-wage families with children.

Between April 1999 and April 2002, Family Credit was replaced by the considerably more generous Working Families' Tax Credit, affecting working families with children. The increase in generosity was particularly large for families with childcare costs. For example, maximum entitlement for a lone parent with one child aged 4 and no childcare costs grew by 21% compared with 93% for the same lone parent but with childcare costs of £98.80 (38 hours at £2.60 per hour). This is because Family Credit included a childcare income disregard, whereas Working Families' Tax Credit had a childcare element that contributed to the maximum award.

Between April 2002 and April 2004, Child Tax Credit replaced Children's Tax Credit and child elements of other benefits included in Working Families' Tax Credit. This also coincided with a modest increase in generosity. In addi-

TABLE XXVI

LOG WAGE ($\ln w$) REGRESSIONS ON CUMULATED EXPERIENCE AND LAGGED WAGES

Moment	Data	Simulated	SE Data	No. SE Diff
		Secondary education		
Constant	0.433	0.444	0.039	0.290
Family bkg: factor 1	0.029	0.029	0.007	0.116
Family bkg: factor 2	−0.006	0.001	0.007	1.067
$\ln w_{t-1}$	0.745	0.742	0.015	0.186
Log cumulated working years	0.073	0.145	0.073	0.986
Lagged log cumulated working years	−0.040	−0.117	0.064	1.212
Variance of residuals	0.050	0.053	0.002	1.294
First order autocorrelation of residuals	−0.010	−0.010	0.001	0.389
		High school		
Constant	0.374	0.345	0.032	0.907
Family bkg: factor 1	0.010	0.011	0.007	0.155
Family bkg: factor 2	0.002	0.008	0.006	0.946
$\ln w$	0.799	0.810	0.011	1.006
Log cumulated working years	0.188	0.191	0.059	0.062
Lagged log cumulated working years	−0.151	−0.162	0.050	0.225
Variance of residuals	0.050	0.053	0.002	1.401
First order autocorrelation of residuals	−0.010	−0.010	0.001	0.570
		University		
Constant	0.606	0.565	0.056	0.736
Family bkg: factor 1	−0.009	0.006	0.011	1.429
Family bkg: factor 2	0.001	−0.006	0.009	0.722
$\ln w_{t-1}$	0.760	0.754	0.020	0.340
Log cumulated working years	0.088	0.185	0.066	1.461
Lagged log cumulated working years	−0.069	−0.156	0.056	1.561
Variance of residuals	0.043	0.046	0.002	1.162
First order autocorrelation of residuals	−0.007	−0.008	0.001	0.914

tion, Working Tax Credit replaced Working Families' Tax Credit and extended entitlement to families without children.

Differences in eligibility and interactions across transfer programs make it hard to use Table XXXIII to deduce the size of the overall gain or loss across years. Therefore, Table XXXIV sets out the net family income for the same six low-wage family types across the four tax and transfer systems. In each case, results are shown for three different hours of work: zero, part-time (18 hours per week), and full-time (38 hours per week). In each case, the wage is assumed to be equal to the April 2004 minimum wage, uprated for inflation. In cases involving childcare costs, childcare is assumed to be required to cover every hour of work at a rate of £2.60 per hour. A partner, if present, is assumed to work 40 hours per week, also at the April 2004 minimum wage.

TABLE XXVII

LOG WAGE ($\ln w$) REGRESSIONS ON AGE

Moment	Data	Simulated	SE Data	No. SE Diff
		Secondary education		
Constant	1.819	1.818	0.035	0.038
Family bkg: factor 1	0.090	0.079	0.019	0.597
Family bkg: factor 2	−0.020	0.003	0.019	1.204
Age	0.051	0.049	0.008	0.249
		High school		
Constant	1.721	1.834	0.042	2.694
Family bkg: factor 1	0.052	0.043	0.023	0.366
Family bkg: factor 2	0.016	0.026	0.021	0.497
Age	0.149	0.110	0.011	3.669
		University		
Constant	2.078	2.072	0.074	0.079
Family bkg: factor 1	−0.022	0.009	0.036	0.881
Family bkg: factor 2	−0.010	−0.034	0.028	0.859
Age	0.145	0.144	0.017	0.036

Childless singles and childless couples were largely unaffected by the reforms, except for the changes between April 2002 and April 2004. Childless singles working full-time and childless couples with one working partner saw substantial increases in generosity (9% and 23%, respectively). This was due to the Working Tax Credit reforms, which extended entitlement to families without children.

Lone parents with no childcare costs saw the largest gains between April 1999 and April 2002, particularly if they worked full-time. This is a consequence of the Working Families' Tax Credit reform. There were smaller gains across all hours of work between April 2002 and April 2004, due to the Working Tax Credit and Child Tax Credit reforms. Lone parents with childcare costs were affected in much the same way, though many of the gains were larger. There was also an increase in generosity for full-time work between April 1995 and April 1999.

Turning to couple parents, the patterns are similar: the biggest gains were felt between April 1999 and April 2002, coinciding with the Working Families' Tax Credit reform. There were also gains between April 1995 and April 1999 particularly for full-time workers and between April 2002 and April 2004 for part- and full-time workers.

TABLE XXVIII

DISTRIBUTION OF LOG WAGES DURING WORKING LIFE

	Secondary				High School				University			
Moment	Data	Sim	SE Data	SE Diff	Data	Sim	SE Data	SE Diff	Data	Sim	SE Data	SE Diff
					Full-time workers							
Mean	2.084	2.065	0.011	1.757	2.298	2.280	0.011	1.666	2.555	2.575	0.014	1.433
Wage: bottom dec ($w_t < Q10$)	0.100	0.125	0.006	4.460	0.100	0.111	0.006	1.886	0.100	0.088	0.009	1.310
$w_t < Q25$	0.250	0.254	0.010	0.340	0.250	0.274	0.011	2.312	0.250	0.239	0.014	0.816
$w_t < Q50$	0.500	0.508	0.014	0.600	0.500	0.524	0.013	1.840	0.500	0.490	0.018	0.570
$w_t < Q75$	0.750	0.760	0.013	0.736	0.750	0.766	0.012	1.322	0.750	0.747	0.015	0.232
$w_t < Q90$	0.900	0.910	0.009	1.085	0.900	0.899	0.008	0.187	0.900	0.881	0.010	2.018
					Part-time workers							
Mean	1.902	1.905	0.011	0.341	2.089	2.104	0.020	0.796	2.474	2.408	0.038	1.726
$y_t < Q10$	0.100	0.113	0.007	1.954	0.100	0.062	0.010	3.879	0.099	0.028	0.019	3.684
$w_t < Q25$	0.250	0.229	0.012	1.774	0.250	0.177	0.017	4.348	0.250	0.224	0.033	0.801
$w_t < Q50$	0.500	0.408	0.016	5.873	0.500	0.435	0.023	2.862	0.500	0.656	0.039	4.021
$w_t < Q75$	0.750	0.719	0.014	2.184	0.750	0.764	0.020	0.667	0.750	0.890	0.035	3.957
$w_t < Q90$	0.900	0.934	0.010	3.496	0.900	0.954	0.013	4.047	0.901	0.973	0.025	2.865

TABLE XXIX

OTHER MOMENTS IN LOG WAGES[a]

Moment	Data	Simulated	SE Data	No. SE Diff
	Mean earnings by family background			
Secondary education, high factor 1	2.073	2.069	0.014	0.261
Secondary education, high factor 2	2.020	2.018	0.013	0.152
High school, high factor 1	2.251	2.247	0.014	0.315
High school, high factor 2	2.278	2.272	0.015	0.373
University, high factor 1	2.525	2.539	0.015	0.910
University, high factor 2	2.530	2.543	0.018	0.748
	Coefficients from regression of log wages on log experience, first differences			
Secondary education	0.111	0.166	0.021	2.602
High school	0.197	0.226	0.016	1.810
University	0.230	0.267	0.021	1.743
	Mean yearly change in log wages if working full-time at $t-1$			
Secondary education	0.024	0.016	0.002	3.603
High school	0.036	0.022	0.002	5.725
University	0.040	0.028	0.003	3.869
	Mean yearly change in log wages if working part-time time at $t-1$			
Secondary education	−0.003	0.012	0.005	3.042
High school	−0.011	0.013	0.006	3.767
University	0.011	0.014	0.011	0.255
	Mean yearly change in log wages if not working at $t-1$			
Secondary education	0.001	−0.002	0.010	0.349
High school	−0.003	−0.002	0.012	0.047
University	−0.019	0.001	0.023	0.908

[a] Experience in the second panel from top is number of years worked in the past.

TABLE XXX

POSITIVE CHILDCARE COSTS AMONG WORKING MOTHERS OF CHILDREN 10 OR YOUNGER

Moment	Data	Simulated	SE Data	No. SE Diff
Secondary education	0.250	0.325	0.014	5.262
High school	0.396	0.403	0.017	0.355
University	0.631	0.462	0.025	6.760

TABLE XXXI

MARSHALLIAN ELASTICITIES OF LABOR SUPPLY—MODEL WITH AND WITHOUT SAVINGS

	Model With Savings		Model Without Savings	
	Extensive	Intensive	Extensive	Intensive
All women	0.475	0.210	0.587	0.254
		By family composition		
Single women with no children	0.419	0.055	0.304	0.199
Lone mothers	1.362	0.378	2.315	0.374
Women in couples, no children	0.220	0.167	0.266	0.200
Women in couples with children	0.553	0.304	0.641	0.309

TABLE XXXII

TAX RATES AND THRESHOLDS UNDER DIFFERENT TAX AND TRANSFER SYSTEMS[a]

	April 1995	April 1999	April 2002	April 2004
Income Tax				
Personal allowance	95.45	105.87	105.97	103.09
Allowance for couples	6.99	4.81	0.00	0.00
Starting rate	20%	10%	10%	10%
Starting rate limit	86.65	36.63	44.09	43.89
Basic rate	25%	23%	22%	22%
Basic rate limit	657.99	683.83	686.6	682.21
Higher rate	40%	40%	40%	40%
National Insurance				
Lower earnings limit/primary threshold	81.67	83.82	106.27	102.81
Entry fee	2%	0%	0%	0%
Main rate	10%	10%	10%	11%
Upper earnings limit	619.54	634.99	698.54	689.17
Rate above upper earnings limit	0%	0%	0%	1%

[a]Amounts expressed in weekly terms and uprated to January 2008 prices using RPI. Allowance for couples is the married couple allowance and additional personal allowance.

TABLE XXXIII

MAXIMUM ENTITLEMENTS AND TAPER RATES FOR EXAMPLE FAMILIES FOR SELECTED BENEFITS AND TAX CREDITS UNDER DIFFERENT TAX AND TRANSFER SYSTEMS[a]

	April 1995	April 1999	April 2002	April 2004
Childless single				
Child benefit	0.00	0.00	0.00	0.00
Income support	65.47	65.28	64.42	62.87
Children's tax credit	–	–	0.00	–
Tax credits	0.00	0.00	0.00	48.02
Lone parent with one child aged 4 and no childcare costs				
Child benefit	23.51	18.29	18.81	18.64
Income support	109.69	108.58	122.04	62.87
Children's tax credit	–	–	12.15	–
Tax credits	93.64	96.52	117.14	162.84
Lone parent with one child aged 4 and with childcare costs				
Child benefit	23.51	18.29	18.81	18.64
Income support	109.69	108.58	122.04	62.87
Children's tax credit	–	–	12.15	–
Tax credits	93.64	96.52	186.30	232.00
Childless couple				
Child benefit	0.00	0.00	0.00	0.00
Income support	0.00	0.00	0.00	0.00
Children's tax credit	–	–	0.00	–
Tax credits	0.00	0.00	0.00	115.69

(*Continues*)

TABLE XXXIII—*Continued*

	April 1995	April 1999	April 2002	April 2004
Couple parents with one child aged 4 and no childcare costs				
Child benefit	14.64	18.29	18.81	18.64
Income support	0.00	0.00	0.00	0.00
Children's tax credit	–	–	12.15	–
Tax credits	93.64	96.52	117.14	162.84
Couple parents with one child aged 4 and with childcare costs				
Child benefit	14.64	18.29	18.81	18.64
Income support	0.00	0.00	0.00	0.00
Children's tax credit	–	–	12.15	–
Tax credits	93.64	96.52	186.30	232.00
Taper rates (all family types)				
Income support	100%	100%	100%	100%
Children's tax credit	–	–	6.67%	–
Tax credits	70%	70%	55%	37%

[a]Amounts expressed in weekly terms and uprated to January 2008 prices using RPI. Amounts ignore disability-related supplements and transition rules. Note that it does not make sense to sum across maximum entitlements for all benefits and tax credits because some cannot be received together. April 1995 child benefit amount includes one parent benefit (later combined with child benefit). Income support calculated assuming adults are aged 25+. Child-related components of income support became part of tax credits in April 2004 system. Couples are not entitled to income support because the partner is assumed to be working full-time. The children's tax credit is an income tax rebate so is only received if income tax is paid. It became part of tax credits in the April 2004 system. Tax credits include family credit, working families' tax credit, working tax credit, and child tax credit. Tax credit maximum amounts calculated assuming entitlement to full-time premium and, where relevant, childcare support for 38 hours per week at £2.60 per hour. Tax credit maximum amount in April 1995 includes full-time premium that was introduced in July 1995. The way childcare was treated for tax credits changed between the April 1999 and April 2002 systems so the maximum tax credit awards are not directly comparable before and after these dates. Tax credits under the April 2004 system additionally incorporate child-related support previously delivered through income support and the children's tax credit. The 37% tax credit taper rate in April 2004 is roughly equivalent to the 55% taper rate in April 2002 because the former operates against gross income and the latter against net income. Also note that under the April 2004 system there was a second taper of 6.67%.

TABLE XXXIV

NET INCOME FOR EXAMPLE FAMILIES UNDER DIFFERENT TAX AND TRANSFER SYSTEMS[a]

Hours of Work	April 1995	April 1999	April 2002	April 2004
Childless single				
0 (not working)	65.47	65.28	64.42	62.87
18 (part-time)	85.62	86.92	87.29	86.91
38 (full-time)	148.16	152.51	154.01	167.15
Lone parent with one child aged 4 and no childcare costs				
0 (not working)	109.69	108.58	122.04	128.66
18 (part-time)	184.32	181.28	201.22	213.83
38 (full-time)	227.14	223.61	263.65	266.51
Lone parent with one child aged 4 and with childcare costs				
0 (not working)	109.69	108.58	122.04	128.66
18 (part-time)	191.96	190.64	236.78	249.39
38 (full-time)	267.80	275.35	332.81	337.14
Childless couple				
0 (not working)	162.49	165.87	164.62	202.47
18 (part-time)	246.60	250.08	246.90	255.17
38 (full-time)	318.01	326.27	325.99	319.20
Couple parents with one child aged 4 and no childcare costs				
0 (not working)	219.49	226.55	263.60	268.25
18 (part-time)	261.24	268.36	302.41	320.96
38 (full-time)	332.65	344.55	356.95	360.52
Couple parents with one child aged 4 and with childcare costs				
0 (not working)	219.49	226.55	263.60	268.25
18 (part-time)	276.39	283.58	335.17	353.72
38 (full-time)	332.65	344.55	407.16	429.68

[a]Notes: Amounts expressed in weekly terms and uprated to January 2008 prices using RPI. Amounts ignore disability-related supplements and transition rules. Calculated assuming a wage equal to the April 2004 minimum wage uprated in line with RPI. A partner, if present, is assumed to work 40 hours per week at the April 2004 minimum wage. Childcare costs calculated as £2.60 per hour for the number of hours worked listed in the table.

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